



Infection Control Audit and Potential Sources of Infection of a Nigerian Eye Unit

L'audit De Controle D'infection De Criteres D'admission De L'unité D'oeil Et Les Sources Potentielles D'infections

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ABSTRACT

BACKGROUND: The prevalence of post-surgical eye infections in Nigeria has not been documented. However, anecdotal reports suggest that post-operative endophthalmitis is fairly common in Lagos.

OBJECTIVES: This study was done to investigate the sources of post-operative eye infections and the preparedness of the hospital to prevent such infections.

METHODS: A bacteriological survey of all eye surgical procedures between September 2004 and June 2005 was performed. Relevant samples were cultured pre – intra and post operatively as required. In the eye clinic, and operation theatre, infection control procedures and practices were audited using a pre-designed questionnaire.

RESULTS: Out of 207 procedures performed, there was no case of post –operative eye infection but potential sources of infections identified included nares of staff, surgical packs, theatre bed, hands of surgeons and conjunctivae of patients. Running water and soap were available for hand washing. There was no specific provision for drying hands in the clinic and staff were observed to carry out hand wash considered ineffective. Staff showed good knowledge of disinfectants and antiseptic use. In the theatre, the staff who handle the steam sterilizer were not formally trained on its use. Although sterile packs were appropriately stored they were not dated. Appropriate types of waste bins were not in use and wastes were not segregated appropriately. Ophthalmic equipment were not adequately disinfected in between patients and use of eye drops for dilatation was communal.

CONCLUSION: Potential sources of post-operative eye infections were identified. Areas of deficiencies in infection control practices, which require proper infection control policies, include handwashing facilities and practices, sterilization procedures, disinfection of ophthalmic equipment, linen management and waste handling. WAJM 2007; 26(3): 196 – 200.

Keywords: Eye, infection, Nosocomial, control; audit

RESUMÉ

Contexte: La prédominance d'infections d'oeil poste-chirurgicales dans Nigéria n'a pas été documentée. Cependant, les rapports anecdotiques suggèrent que cela endophthalmitis poste-opératif est assez commun dans Lagos.

Objectifs: Cette étude a été faite pour examiner les sources d'infections d'oeil poste-opératifs et la préparation de l'hôpital pour empêcher telles infections.

Méthodes: Une étude bactériologique de tout oeil toutes procédures chirurgicales entre le 2004 septembre et le 2005 juin ont été exécutées. Les échantillons pertinents ont été pré cultivé – dans et la poste opérativement comme exigé. Dans la clinique d'oeil, et le théâtre d'opération, les procédures de contrôle d'infection et les pratiques a été vérifié utilisant un questionnaire pré-conçu.

Résultats: De 207 procédures exécutées, il n'y avait pas de cas de poste –l'infection d'oeil opérative mais les sources potentielles d'infections nares incluses identifiées de personnel, les tas chirurgicaux, le lit de théâtre, les mains de chirurgiens et les conjonctives de malades. L'eau et le savon courants étaient disponibles pour le lavage de main. Il n'y avait pas de provision spécifique pour sécher de mains dans la clinique et le personnel ont été observées pour exécuter pour transmettre se lave considéré inefficace. Le personnel a montré la bonne connaissance de désinfectants et d'usage antiseptique. Dans le théâtre, le personnel qui contrôle le sterilizer de vapeur n'a pas été formellement entraîné sur son usage. Bien que les tas stériles ils ont été emmagasinés avec à-propos n'ont pas été daté. Les types appropriés d'huches de gaspillage n'étaient pas dans l'usage et les gaspillage n'ont pas été séparé avec à-propos. L'équipement ophthalmique n'a pas été suffisamment désinfecté entre les malades et l'usage de baisses d'oeil pour dilatation était communal.

Conclusion : Les sources potentielles d'infections d'oeil poste-opératifs ont été identifiées. Les secteurs de manques dans les pratiques de contrôle d'infection, qui exigent les politiques de contrôle d'infection correctes, inclure les facilités de handwashing et les pratiques, les procédures de stérilisation, la désinfection d'équipement ophthalmique, la direction de linge et le gaspillage contrôlant.

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Mots clés : L'oeil, l'infection,, le contrôle d'infection, l'audit

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Abbreviations: CNS, coagulase negative staphylococci; CSSO, Central Sterile Service Department; GND, gram negative bacilli.

INTRODUCTION

The prevalence of post-surgical eye infections in Nigeria has not been documented. However, anecdotal reports suggest that post-operative endophthalmitis is fairly common in Lagos. For proper investigation of outbreaks of post-operative infection however small, organisms cultured from affected patients should be typed and compared with environmental cultures for epidemiological evidence to trace the source of the infection¹. Unfortunately, many of our hospitals have no formal programs in place to monitor and control such nosocomial infections.

Bacteria cause most cases of post-operative endophthalmitis. Gram positive cocci such as the *Staphylococcus* species account for most cases, suggesting that exposure usually occurs during surgery as the result of introduction of organisms from the patient's skin or ocular surface tissues². Other bacteria such as *Bacillus* species, *Pseudomonas aeruginosa*, *Alcaligenes xylosoxidans*, *Serratia marcescens* and other Gram negative bacteria have also been documented as causes of infections^{2,3}. Outbreaks of infection can result from a common source, such as contaminated irrigation solutions, eye drops, and disinfectants^{3,4,5}. Infected patients, hands of medical personnel, surgical equipment and materials and the hospital environment are also known sources of nosocomial infections^{6,7}.

Nosocomial infections are controlled by removing sources or potential sources of infections and blocking routes of transfer of microorganisms from these potential sources to patients. These objectives are achieved through infection control practices such as sterilisation, disinfection, decontamination, aseptic procedures and handwashing. Evidence based standards of practice have been developed and it is now accepted that audit of infection control policies is a key function of infection control teams^{8,9,10}.

Whereas, some ocular infections such as viral conjunctivitis are self-limiting and usually without long-term sequelae, others especially bacterial are sight threatening and ought to be prevented. In order to determine the

prevalence of and investigate post operative eye infections, we decided to carry out a bacteriological survey of eye surgeries in the hospital. We also carried out an audit of infection control practices.

MATERIALS AND METHODS

The study was carried out in the Ophthalmology unit of the Lagos State University Teaching Hospital, Lagos, Nigeria from September 2004 to August 2005. The Ethics and Research committee of the hospital approved the study and informed consent was obtained from all patients.

A bacteriological survey of all eye surgical procedures in the unit was performed over a one year period. Relevant samples which included aqueous humour and conjunctival swabs were collected from every patient undergoing eye surgery. While pre-operative swabs were collected just before surgery, post operative conjunctival swabs were collected two days later, the first time the dressings were removed for eye inspection. Eye-drops, disinfectants and antiseptics used for every surgery were sampled. Every freshly prepared stock and ready to use solutions of antiseptics and disinfectants was cultured. Swabs of surgical packs and equipment and also fomites, were cultured. Sterile swabs were moistened with normal saline and used to wipe the equipment and fomites before each surgery. The contents of the surgical pack for each patient were wiped with moistened swab immediately after surgery. The scrubbed hands of the surgeon before each surgery were swabbed for culture. Every month, nasal swabs were collected from every staff that had contact with the study patients. One moistened sterile swab was used for the two nostrils. The clinical and environmental specimens collected were cultured on blood, chocolate and MacConkey agar and organisms cultured were identified by standard laboratory methods¹. Disinfectants and eye drops were examined by appropriate in-use methods.¹¹

An infection control audit was also performed by the first author, who has had experience performing an infection control audit.¹² The eye clinic and the

operating theatre were audited using a previously designed and tested questionnaire, which covered various infection control procedures and practices including hand washing facilities, protective clothing, cleaning, sterilization and disinfection, linen management, ophthalmic equipment/materials, waste disposal procedures and sharps handling.¹² Available facilities were recorded and all relevant procedures performed on the day chosen for the audit were observed while staff performed their normal duties.

RESULTS

Characteristics of Patients and Clinics. The operating theatre and clinic for ophthalmology patients were separate from the rest of the hospital facilities, but there was no separate ward for the in-patients. Ophthalmology in-patients shared space with others in the surgical ward. However, at the time of this study, all eye surgeries were performed as day cases. A total of 207 eye surgeries were surveyed. Ninety one (43.96%) of the subjects were females while 116 (56.03%) were male patients. Their ages ranged from <1 to 95 years with a mean age of 55 years. The most frequent indication for surgery carried out was removal of cataract followed by correction of glaucoma 175 (84.5%). Others were glaucoma 8 (3.9%), both cataract and glaucoma 1 (0.5%), pterygium 2 (~1%) and others 21 (10.1%).

Bacteriological Survey

There was no case of post operative eye infection during the study period but potential sources of infection were identified (Table 1). Eighty five percent of patients were exposed to staff who harboured *Staphylococcus* species in the nares. Thirty staff consistently harboured *Staphylococcus aureus* while 82 harboured coagulase negative *Staphylococcus* (CNS). There was growth of bacteria in 11 (5.31%) of the 207 surgical packs investigated. Of these, *S. aureus* was cultured from six, CNS from three and Gram negative bacilli (GNB) from two packs. Bacteria were cultured from 51 (24.6%) of 207 theatre beds sampled. Twenty-nine of them were CNS, 18 were *S. aureus*, two were GNB and

two were a mixture of CNS and GNB. A mixture of CNS and GNB was cultured from the washed hands of a surgeon on one occasion. The conjunctiva of 8.7% of the patients was colonized, though not clinically infected post operatively by *S. aureus* (nine), CNS (six), and GNB (three)

Table 1: Potential Sources of Pathogens for Post-operative Eye Infections

Cultured site	N(%)	Contaminated
Noses of attendants	176	(85.0)
Hands of surgeons	1	(0.5)
Theatre beds	51	(24.6)
Surgical packs	11	(5.3)
Eye solutions	0	(0)
Surgical equipment	0	(0)
Conjunctival colonisation	9	(4.4)
Disinfectants /Antiseptics	0	(0)

Total number of surgical procedures = 207

Table 2: Audit of Cleaning, Disinfection, and Sterilization Facilities and Procedures

	Clinic	Theatre
Designated deep sink with warm running water	No	Yes
Detergent	Yes	Yes
Disposable clothes and brushes if appropriate	No	Yes
Hypochlorite solution	Yes	Yes
Are staff aware of proper use of disinfectants?	Yes	Yes
Are sterile packs stored in a clean, dry area?	-	No
Are sterile packs in date?	-	No
Have staff received training on their use?	-	No

Infection Control Audit

Both the theatre and clinic had running water and soap for handwashing, except in the toilets. Bar soap was available in the clinic while liquid soap was used in the theatre. For drying hands in the theatre, one cloth towel per person per surgery was available. There was no specific provision for drying hands in the clinic but gauze was always available for use. Except in the theatre, staff were observed to carry out a hand-wash considered ineffective. Protective clothing was available and appropriately used in the theatre. Sterile and disposable latex gloves, and face masks were available in both the theatre and clinic. Plastic aprons and goggles were available in the theatre but not the clinic. Staff in

both the clinic and theatre showed good knowledge of disinfectant and antiseptic use as well as of the environment at the Eye Unit (Tables 2-4). Appropriate ones were available for equipment and surfaces.

The clinic depended on the Central Sterile Services Department (CSSD) for sterile packs and hot air oven was also used on a daily basis. Steam sterilizer was used in the theatre but staffs were not formally trained on its use. Although sterile packs were stored appropriately, they were not dated.

Ophthalmic equipment were not disinfected in between patients. Tonometer was only wiped on disposable tissue after each use. Sterile disposable surgical blades were used for cornea or conjunctival scrapings. Each patient had his or her own bottle of antibiotic drops, but use of eye drops for dilation was communal and separate bottles were not used for each eye (Table 3).

Clean linen were appropriately stored in the theatre but soiled linen were not separated from infected linen.

In the clinic, though there were bags for infected linen, staff did not wear protective clothing while handling soiled linen. Only the staff in the theatre wore gloves when handling soiled linen. Linen were not machined-slucied only in the hospital. Waste bins were not pedal operated and wastes were not segregated at all in both the clinic and theater. Also wastes were neither sealed nor securely locked away from the public. There appeared to be neither awareness nor knowledge of proper use of sharps containers or action to be taken following an inoculation injury.

DISCUSSION

This study revealed potential sources of eye infection in the hospital of study. Staphylococci isolated from the conjunctiva of patients pre- and post-operatively are normal flora of the patients which could be introduced into the eyes during surgery. Such organisms account for most cases of post operative endophthalmitis.^{13,14} Infection with them is normally avoided by administering prophylactic topical and intra-ocular antibiotics during surgery.

Defective sterilisation procedure

Table 3: Care of Ophthalmic Equipment and Materials at the Eye Clinic

Are Tonometer prisms		
Wiped after each use on disposable paper tissue?		Yes
Tip placed in 1% sodium hypochlorite for 10mins between patients?		No
Is disinfection time extended after use on an infected eye?		No
Is occluder /pinhole		
Stored in 1% sodiumhypochlorite for 10mins between patients?		No
Eye drops		
Does each patient have his/her own bottle of drops?		No
Are there separate bottles for each eye?		Yes
Are expiry dates for antibiotics routinely checked?		No
Slit-lamp biomicroscope		
Are contact areas washed with soap solution in between patients?		No
Patients and Specimens		
Are infected in-patients separated from those who have had surgery?		Yes
Are there sterile disposable surgical needle/blade for cornea or conjunctiva scrapings?		Yes

Table 4: Audit of the Environment at the Eye Unit

Facility	Clinic	Theatre
Clean walls	Yes	Yes
Mosquito nets (beds)	No	No
Window nets	No	No
Wash hand basin in toilets	No	Yes
Running water in toilets	No	Yes
Soap present in toilets for handwashing	No	No

as shown by growth in some of the sterile packs is a reflection of the hospital policies on sterilization. The theatre depended on the CSSD for some sterile packs but also possessed a steam sterilizer for eye instruments. However, staff did not receive formal training on its use. Furthermore, it was not possible to verify whether the packs were expired or not because they had no dates on them. Faulty sterilisation process has been a cause of outbreak in the past⁶.

The disinfectants and antiseptics used for surgery remained sterile throughout the study period and no organism was cultured from any surgical instrument. This is consistent with the

observation of proper use of disinfectants by staff. However, the fact that 24% of patients were exposed to contaminated theatre beds necessitates a review of the procedure for decontaminating the theatre beds. Perhaps the frequency of decontamination should be increased since many patients are operated on daily, and each of them if infected or colonized with these organisms has the chance to contaminate the bed and ultimately vulnerable eyes via the hands of patients or hospital staff.

A gram negative bacterium was cultured from the scrubbed hand of one surgeon, and only on one occasion. Since a sterile antiseptic was used, the lapse was most likely due to an ineffective handwash by the surgeon. The staff in the clinic were also observed to perform a handwash considered ineffective. Obviously they would benefit from an update on effective handwashing¹⁵. In addition, there should be a specific policy on drying hands as this is a standard infection control practice¹⁵. The importance of handwashing in preventing nosocomial infections is well established, but studies have shown that complacency of healthcare providers with quality often results in low rates of compliance with standard practices and deficiencies of facilities^{16,17}.

In the clinic, a bar soap and not liquid soap was provided for hand washing. While bar soap is cheaper and more convenient to use, it can be contaminated by bacteria on the users' hands; bacteria like *Pseudomonas* can grow in it and get transmitted between users, unlike liquid soap which has no contact with the users' hands¹⁸. However, there are no studies showing that contaminated soaps have been sources of infection, but it has been shown that keeping bar soaps dry may reduce the rate of contamination¹⁹.

Most of the patients were exposed to staff who harboured staphylococci in their nares, a number of which were methicillin-resistant. While infection in the patient with these colonizers in the healthcare worker could be prevented with scrupulous handwashing and wearing of masks, carriage of methicillin resistant *Staphylococcus aureus*

(MRSA) in the healthcare worker should be eradicated with a topical agent like mupirocin²⁰.

Ophthalmic equipments like the tonometer and slit lamp biomicroscope were not routinely disinfected in between uses by patients. Contaminated or inadequately disinfected tonometers have been associated with outbreaks of viral conjunctivitis and time should be spent on disinfecting them even in a very busy clinic.²¹

Eye drops could be a source of outbreaks because they easily get contaminated by conjunctival flora and multiuse containers could be a vector for organisms like *S. epidermidis* and *Pseudomonas* species.^{22,23} Single use of eyedrops is ideal. In this study, each patient had his own bottle of antibiotic eye drops. This policy should be in place also for drops for dilating the eyes prior to any ophthalmic procedure or surgery.

The audit showed other major areas of deficiencies such as linen management and waste handling showing that the hospital does not have standard policies in these areas^{24,25}. Ward-based segregation of waste is an essential initial step in safe disposal of waste just like separation of infected and soiled linen is necessary where it is not feasible to machine sluice all linen. Proper practice is necessary in these areas to protect staff, environment and community from not only blood borne pathogens, but also bacterial respiratory, enteric and soft tissue infections.²⁶⁻²⁸

It is not surprising that no case of infection was found in this study. The incidence of postoperative eye infection is generally kept low by the routine use of topical and intra-ocular antibiotics for prophylaxis. Despite this measure however, outbreaks do occur when there are lapses in infection control practices.^{13,14,29} So infections will occur in the future if the potential sources of infections identified in this study, including contaminated surgical packs, colonised nares of hospital staff, and contaminated theatre beds are not taken care of. Areas of deficiencies in infection control practices, which included handwashing facilities and practices, sterilization procedures, disinfection of ophthalmic equipment, linen management

and waste handling need to be looked into. The hospital needs to have an infection control program run by an infection control team, which will monitor rates of nosocomial infections and an infection control committee which will put in place proper infection control policies in the identified areas of deficiencies. Staff need an update of their knowledge on effective handwashing and other infection control practices.

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